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IMPACT ON BASE POPULATION DENSITY AND HUNTER PERFORMANCE OF STOCKING WITH PEN-RAISED BOBWHITE

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Abstract:

In 1962, the Kansas Fish and Game Commission initiated an investigation to determine the effect of semiannual releases of pen-raised bobwhite quail (Colinus virginianus) on population densities of native wild quail populations, on availability of birds to hunters, and on hunter success.

Stocking during spring resulted in 7% fewer birds in the fall population on the stocked area than on the control area. Stocking during fall resulted in 14% more birds, at the time hunting season began, on the stocked area than on the control area. Neither of these differences were statistically significant, and it is concluded that there was no significant difference attributable to stocking between population densities of stocked and control areas. On the stocked area, however, there was a significant net increase of 25% in population density between the fall census period and the preseason census period. It is concluded that the density-depressing influence of spring stocking combined with the density-elevating influence of fall stocking, on the stocked area, produced a significant increase, attributable to stocking, between the population density preceding fall release and the population density preceding the hunting season. It is further concluded that in the comparison of preseason population densities for the treatment and control areas, the depressing effect of spring stocking and the elevating effect of fall stocking resulted in a treatment-area population that was significantly larger than that found on the unstocked control area.

Some pen-raised birds established themselves as a part of the population on the stocked area, but there was not a proportional increase in population density. There were fewer native quail on the area when treated with semiannual stocking than when under control condition. The difference in density of native birds between stocked and control areas was not statistically significant.

Stocking significantly increased hunter success by 30% and 35% on areas in Cherokee and Linn Counties, respectively, but the number of coveys flushed per hour was not significantly increased by stocking pen-raised quail.

Bobwhite quail (Colinus virginianus) stocking has been an active program in Kansas since 1922 when the Kansas Fish and Game Department purchased 486 quail from Mexico and experimentally released them in 42 counties. Trapping and transplanting wild native birds or purchasing pen-raised birds for release continued through 1934.

In 1933 and 1935, the Department opened the Pittsburgh and Calista game farms, respectively, to raise quail for release in Kansas. Production from the 2 farms totaled 5,268 birds in 1935. The peak of quail stocking in Kansas came in 1955 when 40,789 birds were released. In 1969, the Calista farm was closed, production at the Pittsburgh farm was reduced, and releases of quail were restricted to the eastern 0.25 of the state.

This paper is based on information obtained under Pittman-Robertson Project W-23-R, Job A-3 entitled Survival and Harvest of Pen-raised Bobwhite Quail. The study had as its primary objective to measure, in terms of hunter success, availability of birds to the hunter, changes in population densities, economics, and the effect of supplementing native wild populations of bobwhite quail with releases of pen-raised quail.

Study Areas and Methods

Data presented in this paper were collected from 3 pairs of study areas. These areas represented some of the variations in cover conditions typical of primary quail range in Kansas.

Two pairs of areas were designated as "extensive" areas from which only weekend hunter bag-check data were collected. On these areas the effect of stocking on hunter performance was the sole objective evaluated. One pair of areas was designated as "intensive" study areas where hunter bag checks were conducted throughout the season and population census data were collected for evaluating the effects of stocking on both hunter performance and population density.

The extensive study areas were located in Cherokee and Greenwood Counties, and the intensive areas were located in Linn County. Data were collected on the extensive areas during 1962-1967. A change in location of the Linn County areas delayed the study of these areas to the 1964-1969 period.

The Cherokee County areas were located primarily on state-owned strip-mined lands, although some private acreage was involved. Cherokee County is situated in extreme southeast Kansas and is within the ecotone between tall-grass prairie and deciduous forest. Vegetation on the areas is dense and topography is considered rugged for Kansas. The Greenwood County areas were situated on the state-controlled Fall River Game Management Area, located within tall-grass prairie at the southern end of the Flint Hills. The Linn County areas, typical of east-central Kansas farmland, were privately owned. Brushy pastures and small cultivated fields, bordered by hedgerows, characterize the Linn Co. areas.

Each study area was approximately 1-mile square and located at least 1 mile from any other study area to minimize movement of birds from 1 area to another. One area of each pair was stocked for 3 consecutive years (Code Sc) while the other area (Code Cs) served as an unstocked control. After 3 years, the roles of the areas were reversed for the second 3-year period. Thus variability due to differences in site would be controlled statistically.

Quail were released during April and October on all treatment areas. One hundred and forty-four quail were released on each of the extensive treatment areas during each release period. During the first year of study, 120 and 144 birds were released in the spring and fall, respectively, on the Linn County stocked area; however, due to excessive egress the stocking rate was reduced to 60 birds per release period, with a 6-year average stocking rate of 70 and 74 birds for the spring and fall releases, respectively. The average spring stocking rate in Linn County was 108% of the average spring base population (65 birds) and the average fall stocking rate was 48% of the average fall base population (154 birds).

Eight-to-10-month-old birds were released in the spring and 16-to-17-week-old birds were used for the fall release, each release containing an equal number of males and females. Fall releases were made approximately 1 month prior to the opening of quail hunting season.

Dense cover types were chosen as release sites, and no additional food or water was provided at a release site. When 144 birds were stocked, 6 releases of 24 birds each were made at various locations on the area; 3 releases of 20 birds each were made when 60 birds were stocked.

Hunter bag checks were conducted by Department personnel on opening weekend on the extensive areas and throughout the season on the intensive areas. In addition, persons wishing to hunt on the intensive areas were required to obtain the landowners' permissions. If permission was granted, the hunting party received a data sheet and instruction sheet from the landowner. Boxes for deposit of these sheets were located on the perimeter of the areas.

A major proportion of the total investigative effort was devoted to censusing quail populations on the Linn County areas. Censusing was practically continuous from the end of a hunting season (various dates in January) until the next hunting season began (third Saturday in November). The overall censusing effort was divided into 5 periods: (1) end of hunting season to 15 March, (2) 16 March to spring stocking date in mid-April, (3) spring stocking date to 31 August, (4) 1 September to fall stocking date in mid-October, and (5) fall stocking to opening of the hunting season. These 5 periods were designated as: (1) winter census, (2) spring census, (3) summer census, (4) fall census, and (5) preseason census, respectively. Census data revealed that numbers of quail in the population declined during winter and spring, increased during summer, and varied up or down during the fall and preseason census periods. Therefore, final census figures presented in these pages represent the numbers of quail in the populations at the end of each period.

Censusing methods employed varied with the time of year. The primary method used during all periods was to walk through all areas containing vegetative cover (bare ground, such as a recently plowed field, was not searched) recording the location and numbers of all quail observed. Large areas of cover were censused by walking along transects, the transect line spacing depending on the density of the cover present.

Small areas were searched along a zig-zag course. In either case the objective was to get a complete census of the entire study area rather than a sample from which to estimate the numbers of quail on the study area. A bird dog was used to locate quail when conditions were favorable. Approximately 1 week was spent on each study area during each census period to obtain final flush counts for the period.

Other sources of information concerning population status were track counts when snow was present, recapture of marked quail, and reports from resident farmers. During the summer, perimeter and interior roads were patrolled by vehicle through the early morning and late evening to locate broods and pairs. Attention to calls produced by the birds was helpful during the general censusing. The study leader performed all censusing.

Data were analyzed by 2-way analysis of variance in which variation among years and variation between treatment and control were tested for significance. Differences among test data were considered significant at $P<0.20$.

Results

Population Density

Population data from Linn County, presented in Table 1, were used to test the effects of spring stocking on subsequent fall populations and on the effect of fall stocking on subsequent preseason and breeding population levels.

The average numbers of birds in the fall populations (before fall stocking) were 154 on the stocked area and 166 on the control area. There were 7% fewer birds on the stocked area than on the control area, but the difference was not significant. We concluded that spring stocking produced no significant difference between fall population densities of the stocked and control areas.

The average numbers of birds in the preseason populations (after fall stocking) were 193 on the stocked area and 170 on the control area. There were 14% more birds on the stocked area than on the control area but the difference was not significant. We concluded that fall stocking produced no significant difference between the preseason population densities of the stocked and control areas. More exactly, semiannual stocking produced no significant difference in population density of the stocked area when compared with population density of the control area during the fall census period (before fall stocking) or the preseason census period (about 30 days after fall stocking).

On the stocked area, spring stocking produced a depressing effect on the fall population density and fall stocking produced an elevating effect on the preseason population density. There was a gross population increase of 39 birds on the stocked area and of 4 birds on the control area, between the fall census (before fall stocking) and preseason census periods. The net increase in population (35 birds) on

the stocked area amounted to 23% of the fall population (before fall stocking) present on the stocked area; this difference in population density between the fall census and preseason census periods was statistically significant ($P<0.05$) and attributable to stocking. If this study had been limited to pre- and poststocking censusing of a single-treatment area (no control) the conclusions drawn would have been quite different (see preceding paragraph).

The average numbers of birds in the spring populations (before spring stocking) were 65 on the stocked area and 63 on the control area. The 2 figures did not differ significantly. Because this was a test of the effects of releases in previous years on the subsequent breeding population, 1964 spring census data was omitted as this was the first year of the study. Mean data cited were for years 1965-1969. It is concluded that semiannual stocking produced no significant difference between the subsequent spring population densities (before spring stocking) of the stocked and control areas; in other words, there was no increase in spring population densities attributable to semiannual stocking during a previous year.

Twenty-three % of all birds bagged on the Linn County stocked area were birds released during fall; 3% of the harvest on stocked areas were birds released in the preceding spring. If the composition of the harvest is used as a measure of composition of the total quail population on the stocked area, there were 6 birds from the spring stocking, 44 from the fall stocking, and 143 birds that were native birds or progeny of spring-stocked birds in the preseason population of 193 birds. Thus, 91% of the spring-stocked birds and 41% of the fall-stocked birds were no longer on the stocked area when the hunting season began. Furthermore, the stocked area contained 143 native birds (possibly less if progeny of spring-stocked birds could be identified) and 50 pen-raised birds, while the control area contained 170 native birds. The inferences drawn are: (1) spring stocking had a depressing influence on fall population density, resulting in 7% fewer total birds in the population and 16% fewer native birds (not a statistically significant difference) in the population; (2) fall stocking had an elevating influence on the depressed fall population, resulting in 23% more birds than the depressed level before fall stocking and 14% more birds than the control or normal population level; and (3) semiannual stocking produced a mixture of 74% native birds and 26% pen-raised birds in the fall population, but did not produce a significantly higher population density than occurred on the control area.

Immediately after spring stocking there were 135 birds on the stocked area and 58 birds on the control area. The preseason populations were 193 birds on the stocked area and 170 birds on the control area. The ratios of spring (poststocking) populations to preseason populations were 1:1.43 and 1:2.93 for the stocked area and control area, respectively. Even though the stocked area received a fall stocking (74 birds, average) the rate of recruitment was much higher on the control area. From this we hypothesize: spring stocking causes a reduction in summer recruitment (chick production) which results in a fall population density no higher (probably lower) than occurs without spring stocking;

fall stocking causes an excessively high population density accompanied by an increase in rate of loss of birds (pen-raised and native) from the area; and, the proportion of pen-raised birds in the preseason population is a function of reduced summer recruitment (chick production) and lingering effect of fall stocking.

Hunting Data

Hunter success (gun hours/bird bagged) and availability of birds to hunters (party hours/covey flushed) were used to measure the effects of stocking in terms of tangible benefits to the hunter. If stocking is of significant benefit we would expect better hunting success and increased availability of birds to the hunter on areas where pen-raised birds have been released.

In Linn County, hunters required 1.00 gun hour to bag a quail on the stocked area and 1.53 gun hours on the control; this difference was significant ($P<0.20$). The stocked area yielded 35% better hunter success than the control area in Linn County.

On the Greenwood County areas, the mean gun hours/bird bagged was 1.80 for the stocked area and 1.77 for the control; the difference was not statistically significant.

On the Cherokee County areas, the mean number of gun hours/bird bagged was 1.13 on the stocked area and 1.62 on the control. The difference between the 2 means was significant ($P<0.10$) and amounted to 30% better hunter success on the stocked area.

Hunting parties in Linn County required 1.07 hours per covey flushed on the stocked area and 0.97 hours on the control. These means were not statistically different.

On the Greenwood County study area, parties hunted 1.56 hours/covey flushed on the stocked area and 1.27 hours/covey flushed on the control. The difference between the 2 means was significant ($P<0.10$), indicating 19% greater availability of birds to the hunter on the control area than on the stocked area.

On the Cherokee County areas, the means of party hours/covey flushed, 1.13 for the stocked area and 1.31 for the control, did not differ significantly.

Conclusions

Pen-raised quail are released in spring to add breeding stock to the population of native birds, in the hope of increasing fall population due to progeny of the released birds. We did not attain this objective, as there was no significant difference between the average fall population on the stocked and unstocked areas. In fact, the average population size prior to stocking in the fall was lower on the stocked area than on the control area, demonstrating that birds stocked in spring did not add significantly to the fall population. We believe

that spring stocking caused a reduction in summer recruitment (chick production), resulting in a lower average fall population on the stocked area.

Fall releases are made to increase the total fall population and thereby increase hunter success. A secondary purpose for increasing fall populations by fall stocking is to increase fall population carryover into the spring breeding population. Fall stocking did not result in a significantly higher prehunting season population on the stocked area than on the control area. However, as a probable immediate result of increased population pressures produced by fall-released birds, native quail are more likely to be lost from the stocked area at a higher rate than would occur without fall stocking, being replaced by pen-raised birds that survive on the area. As a result, there was actually a lower native population (though not significantly lower) on the stocked area than on the control area. It seems likely that native quail lost through poor production and increased rate of loss from the population are replaced by released pen-raised birds that trigger the losses, but the mechanics of cause-and-effect remain obscure and the concept is hypothetical.

Birds released in the fall did not contribute significantly to the subsequent breeding populations.

Hunter success was increased by stocking pen-raised quail. A population containing 26% pen-raised birds and 74% native birds resulted in increased vulnerability of birds to the gun and an increase in hunter success.

Stocking of quail did not significantly increase the availability of birds to the hunter. Behavior of released birds may contribute to an actual increase in the amount of time spent between covey flushes, as was the case on the Linn and Greenwood county areas.

Table 1. Number of bobwhite quail on the Linn County study areas during each census period 1964-65 - 1969-70.

Treatment	Study year	Spring	Fall	Preseason	Winter[a]
Stocked areas					
Sc[b]	1964	68	104	179	63
	1965	62	190	243	78
	1966	63	239	278	114
Cs[c]	1967	60	94	114	67
	1968	63	149	179	86
	1969	75	146	164	80
Mean		65	154	193	81
Control areas					
Cs[c]	1964	32	99	99	39
	1965	38	182	182	57
	1966	46	155	155	60
Sc[b]	1967	109	208	208	94
	1968	74	232	220	64
	1969	50	120	154	72
Mean		58	166	170	64

[a] Census made in years 1965-1970.

[b] Sc = areas stocked 1964-1966; control 1967-1969.

[c] Cs = areas control 1964-1966; stocked 1967-1969.

Table 2. Gun hours/bird bagged on the Linn, Greenwood, and Cherokee county areas, 1962-1969.

Area	Treatment	Year and gun hours/bird bagged								Mean
		1962	1963	1964	1965	1966	1967	1968	1969	Gun hours/bird bagged
Linn	Stocked	----	----	1.00	0.77	0.89	1.06	0.90	1.40	1.00
	Control	----	----	1.61	2.71	0.76	1.31	1.60	1.21	1.53
Greenwood	Stocked	2.89	1.15	1.25	2.07	1.62	1.84	----	----	1.80
	Control	2.09	1.58	1.38	2.27	1.86	1.46	----	----	1.77
Cherokee	Stocked	1.02	1.16	1.27	1.27	1.36	0.70	----	----	1.13
	Control	0.86	2.40	1.36	2.44	1.71	0.98	----	----	1.62

Table 3. Party hours/covey flushed on the Linn, Greenwood, and Cherokee county areas, 1962-1969.

Area	Treatment	Year and party hours/covey flushed								Mean
		1962	1963	1964	1965	1966	1967	1968	1969	party hours/covey flushed
Linn	Stocked	----	----	1.18	0.99	0.91	1.62	0.69	1.05	1.07
	Control	----	----	1.09	0.89	0.89	0.91	1.13	0.91	0.97
Greenwood	Stocked	1.29	1.11	1.39	2.13	1.84	1.60	----	----	1.56
	Control	0.92	1.06	1.00	1.41	1.76	1.45	----	----	1.27
Cherokee	Stocked	1.28	1.15	0.96	0.96	1.46	1.00	----	----	1.13
	Control	1.00	1.00	1.45	1.73	1.96	0.75	----	----	1.31